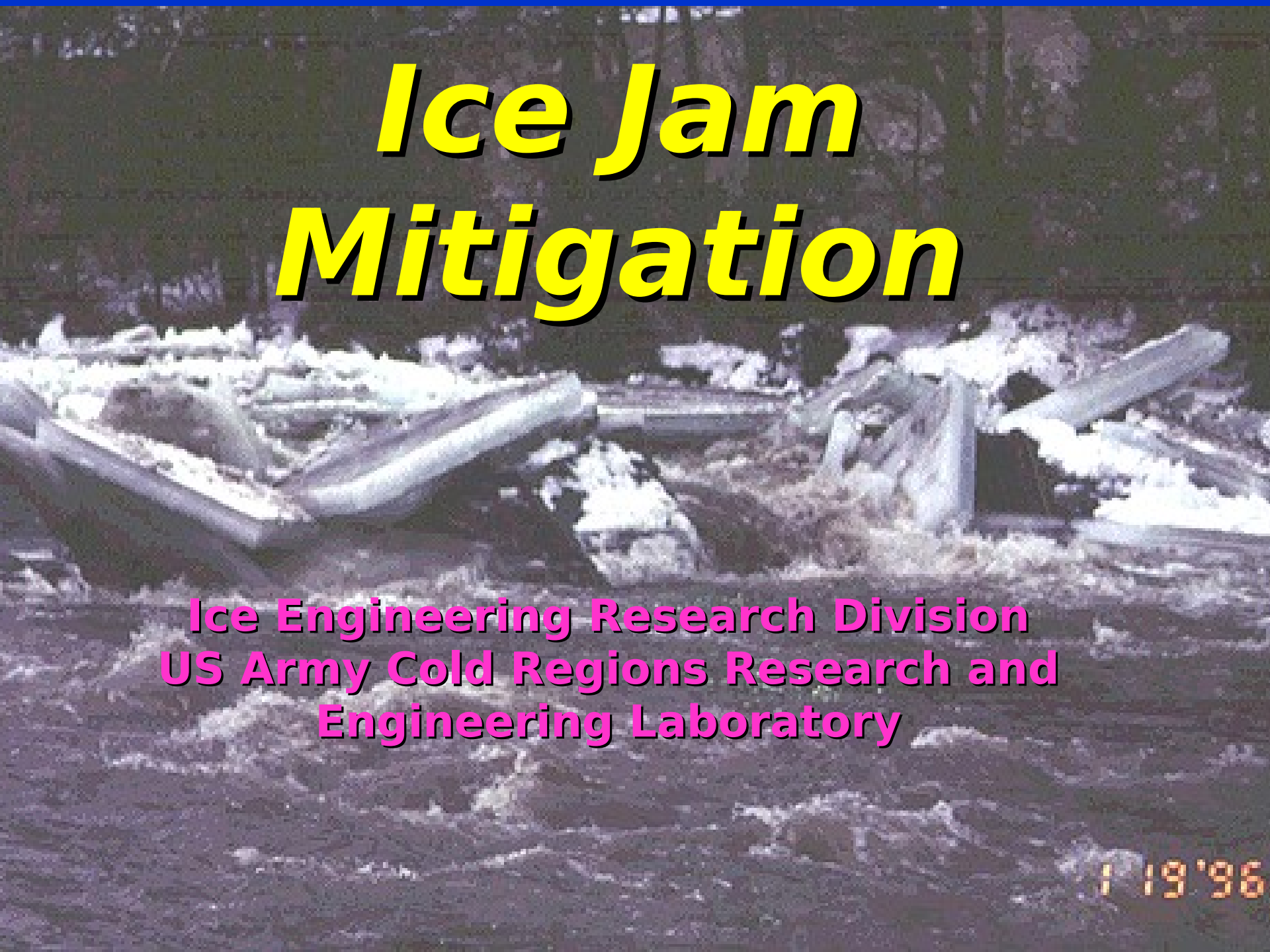

Ice Jam
Mitigation
Ice Engineering Research Division
US Army Cold Regions Research and
Engineering Laboratory
19'96

Outline

- Objectives
- Classification
- Advance Measures
- Early Warning
- Emergency Measures
- Permanent Measures
- Assessing Effectiveness

Mitigation Objectives

- Reduce ice jam flood damages, B/C > 1
- Reliable performance
- Low environmental impact

Middlesex Blames Montpelier For Flooding

By ERICA HOUSKEEPER
Times Argus Staff

MIDDLESEX — Residents are blaming Montpelier officials for failing to notify them of potential flooding that stemmed from ice-breaking procedures on the Winooski River in the capital Friday.

Homes on Three Mile Bridge Road were invaded by flood waters on Friday night after Montpelier officials began to break up ice on the river to create a channel of water near the Interstate 89 exchange.

The channel prevented ice from backing up in Montpelier and in Berlin.

"It was not an attempt to damage someone else's property," Montpelier City Manager Bill Fraser said this morning.

Montpelier Police Chief Douglas Hoyt said that flooding was imminent. "My response is, whose ice is it? Berlin's? East Montpelier's? Who notified us? We have a plan, and we followed it."

But Middlesex homeowners contend that the flooding could have been prevented if their town officials had received proper notice from Montpelier officials.

After the flooding occurred, the Middlesex Volunteer Fire Department assisted residents, who plan to bring their concerns to a regularly scheduled Middlesex selectboard meeting tonight at 7.

"It's a situation where Montpelier flushes the toilet onto us," said Amy Welti-Darling, who

David Marie/Times Argus

Jeffrey Darling surveys the damage around his home on the Three Mile Bridge Road in Middlesex. Rising waters in the nearby Winooski River flooded the home and left massive ice chunks and debris in the yard.

Jeffrey, have flood insurance for their home, they do not have in-

inson's wife, Shelly, and their three children are staying with

this is not the first time this has happened," she said, referring to

idents are blaming Montpelier officials for failing to n
hem of potential flooding stemming from ice-breakin
rocedures on the Winooski River in the capital Friday

Classification

- Process
  - freezeup
  - breakup
- Lead Time
  - advance
  - early warning
  - emergency
  - permanent

Freezeup Control

- Control production and transport of frazil ice
- Displace jam initiation location

Breakup Control

- Control timing of ice breakup
- Displace jam location

- Freezeup
  - gradual production and accumulation
    - reduce production
    - collect ice in safe place

- Breakup
  - dynamic breakup and arrest
    - reduce ice volume
    - arrest run in safe place
    - allow run to pass

Goals of Advance Measures

- **Flood protection**
- **Reduce ice supply**
- **Control breakup sequence**
- **Increase conveyance**

Advance Measures

- non-structural intervention
- two weeks to six months lead time
- can be inexpensive
- effective?

Advance Measures - Breakup

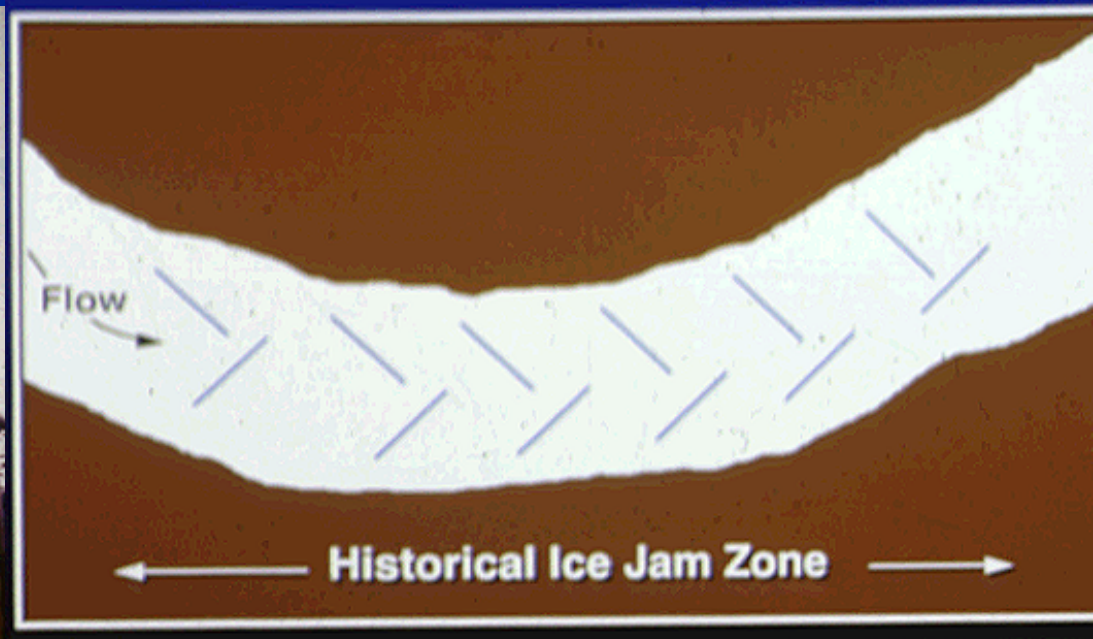
- Ice weakening
  - weaken ice to pass ice run
  - mechanical & thermal methods
  - 2-6 weeks before breakup
  - watch downstream
  - very low cost
  - effective?

Mechanical Weakening

- Immediate strength reduction
- Ice cutting
  - 4WD trencher
  - amphibious ice saw
- Ice breaking
  - amphibious excavator
  - vessels

Ice Cutting

- Beaurivage River, Quebec
  - 4WD trencher
  - diagonal slot pattern, center 2/3
  - ice moves through cut area



Ice Breaking

- Aroostook River, ME
  - 18-ton amphibious excavator
  - breaks open channel
  - ice moves into dam pool

Ice Breaking

- Icebreakers
  - can clear channels in jams
- hovercraft
  - effective for sheet ice

Thermal Weakening

- Accelerate natural ice deterioration
- Dependent on meteorological conditions
- Hole drilling
- Dusting

Hole Drilling

- Oconto River, WI
  - 10 ft grid, central 2/3 of channel
  - holes expand to weaken sheet
  - ice moves into Lake Michigan

Aerial Dusting

- Yukon River, AK
  - sand increases solar absorption
  - 25 years, high productivity
  - difficult to assess effectiveness

Dusting - Hydroseeder

- Winooski & White Rivers, VT
  - mulched leaves
  - road access, hose extension

Early Warning

- Ice motion detectors
- Trained observers
- Provides critical information
- Two weeks to six months lead time
- Inexpensive and invaluable

Ice Motion Detectors

- Trip wires in ice
  - alarms inform emergency managers
  - select locations to give days/hours warning
- Other:
  - stream gage, satellite, cellular phone

Trained Observers

- Part of emergency response team
- Track pre-event ice conditions
- Check U/S & D/S during event
- Helpful for after-action assessment, permanent measures

Goals of Emergency Measures

Flood protection

Increase conveyance

Remove ice

Emergency Measures

- Jam in place
- Cost & effectiveness depend on timing
  - try to minimize damages
  - time is critical
- Excavation
- Blasting
- Flood Fighting
- Do nothing

Excavation - Stage Rising

- immediate flood threat
- pre-positioned equipment
  - excavator, clam-shell, bulldozer
  - clear channel D/S of toe
  - dislodge key pieces at toe
- can be inexpensive (& nerve wracking)

Excavation - Stage Falling

- second flood threat possible
- bulldozer clears channel
  - from D/S, through toe
- dislodge key pieces
  - blasting, clam-shell
- expensive to excavate ice pieces
- access difficult

Excavation - Examples

- Gorham, NH
- Morrisonville, NY

Click here to view remainder of presentation